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A REVIEW OF THE LIZARD-FISHES OR SYNODONTIDÆ OF THE WATERS OF JAPAN

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BY

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Of Stanford University

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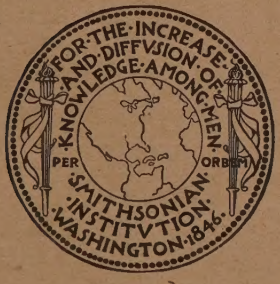

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A REVIEW OF THE LIZARD-FISHES OR SYNODONTIDÆ OF THE WATERS OF JAPAN.

By David Starr Jordan and Albert Christian Herre,
Of Stanford University.

In this paper is given an account of the Japanese species of the family of lizard-fishes or Synodontidæ. It is based on material collected in 1900 by Professors Jordan and Snyder, and series of specimens are in the United States National Museum and in the museum of Stanford University.

Family SYNODONTIDÆ.

Body oblong or elongate, little compressed, with cycloid scales, rarely naked; mouth very wide, the entire margin of upper jaw formed by the long, slender premaxillaries, closely adherent to which are the slender maxillaries, the latter mostly rudimentary or obsolete, never widened at tip; teeth mostly cardiform on both jaws, tongue, and palatines; canines rarely present; large teeth usually depressible; no barbels.

Opercular bones usually thin, but complete; gill membranes separate, free from isthmus; branchiostegals usually numerous; pseudobranchiæ present; gill-rakers tubercular, obsolete, or modified into teeth; no orbitosphenoid or mesocoracoid; lateral line present; dorsal fin moderate, of soft rays only, its insertion median; ventrals rather large, median; pectoral fins small, inserted high; caudal forked, vertebræ numerous, essentially similar; fishes of sandy bottoms in the warm seas; adipose fin present.

In Japan, these fishes are known as *Eso*.

KEY TO GENERA.

a. Synodontinæ. Teeth simple; gape wide; flesh firm.
  b. Teeth on the palatines in a single band on each side.
    c. Snout very blunt, shorter than eye; anal fin longer than dorsal.
      Trachinocephalus, 1.
    cc. Snout rather acute, longer than eye; anal fin much shorter than dorsal.
      Synodus, 2.

bb. Teeth on the palatines in two bands on each side; snout rather acute; anal fin shorter than dorsal.....*Saurida*, 3.

aa. HARPODONTINÆ. Canine teeth of lower jaw barbed; flesh very soft; scales very thin; long teeth more or less depressible; anal fin moderate.

Harpodon, 4.

1. TRACHINOCEPHALUS Gill.

Trachinocephalus GILL, Cat Fish Eastern Coast N. Amer., 1861, p. 53 (*myops*); (name only; first defined in Proc. Acad. Nat. Sci. Phila., 1862, p. 241).

Goodella OGILBY, Proc. Linn. Soc. N. S. W., XXII, 1897, p. 249 (*hypozona*= young of *myops*.)

Body elongate, robust, compressed; head large, deep, laterally compressed, its form much as in the genus *Trachinus;* snout very short, blunt; teeth as in *Synodus*, but more slender, smaller, and closely set; lower jaw projecting; vent well forward, very slightly nearer base of caudal than base of ventrals, under tip of last dorsal ray.

This genus is very close to *Synodus*, from which it differs chiefly in form of head and body and in the relative development of the fins, the anal fin especially being longer than the dorsal and provided with more rays.

A single species known, widely disseminated in the tropical waters of the Atlantic, Pacific, and Indian oceans.

(τράχινος, trachinus; κεφαλή, head.)

1. TRACHINOCEPHALUS MYOPS (Forster).

OKIESO (OFF-SHORE ESO).

Salmo myops FORSTER in Bloch and Schneider, Syst. Ichth., 1801, p. 421 (St. Helena).

Saurus myops CUVIER, Règne Animal, 2d ed., 1829, p. 268 (after Forster).—GÜNTHER, Cat Fish, V, 1864, p. 398 (Cuba, Jamaica, Japan, Amboyna, Pinang, Mauritius, Port Jackson).—DAY, Fishes of India, p. 503, pl. CXVII, fig. 5 (Madras).—ISHIKAWA, Prel. Cat., 1897, p. 22 (Kagoshima, Bonin Is.).

Synodus myops BLEEKER, Atlas Ichth., VI, p. 153, 1870–1872, pl. CCLXXVIII, fig. 3 (Sumatra, Pinang, Bangka, Bali, Celebes, Batjan, Amboyna, Ceram).

Trachinocephalus myops JORDAN, Proc. U. S. Nat. Mus., XIII, 1890, p. 314.—JORDAN and EVERMANN, Fishes of Hawaiian Islands, Bull. U. S. Fish Comm., XXIII, Pt. 1, 1903 (July 29, 1905), p. 62, fig. 13 (Hilo, Honolulu).

Osmerus lemniscatus LACÉPÈDE, Hist. Nat. Poiss., V, 1803, p. 236 (Martinique; after Plumier).

Saurus truncatus AGASSIZ, Pisc. Brasil, p. 82, 1829, pl. XLV (Brazil).

Saurus limbatus EYDOUX and SOULEYET, Voyage Bonite, Poiss., 1841, p. 199 (Hawaii).

Saurus trachinus TEMMINCK and SCHLEGEL, Fauna Japonica, Poiss., 1842, p. 231, pl. CVI, fig. 2 (Nagasaki).

Trachinocephalus trachinus JORDAN and SNYDER, Proc. U. S. Nat. Mus., XXIII, 1900, p. 350 (Tokyo); Check List, 1901, p. 57 (Yokohama).

Saurus brevirostris POEY, Memorias, II, 1860, p. 385 (Cuba).

Goodella hypozona OGILBY, Proc. Linn. Soc. N. S. W. 1897, p. 250 (New South Wales); young form.

Habitat.—Warm parts of Atlantic and Pacific, on nearly all coasts.

Head 3.5 in length; depth 5; head broad, its width a little less than half its length; depth of head 1.6 in its length; snout equals interorbital space, 1.5 in eye; eye 3 in maxillary; maxillary 1.85 in head; pectoral 2.25 in head; ventral 1; base of anal 3.67 in body; length of depressed dorsal 3.75; D. 13; A. 16; P. 12; V. 8; scales 4–55–5.

Body elongate, compressed, deepest just back of head, tapering gradually backward, with a long tail; head large, compressed laterally, deep, the snout blunt and very short; eye small, high, well forward, the adipose eyelid rudimentary; mouth large, oblique; mandible large, slightly projecting, the profile forming a convex curve to below pectoral; lips thin, teeth in upper jaw exposed; teeth in jaws more or less unequal, in double series; no vomerine teeth; palatines with a single series; tongue free in front, with a triangular patch of depressible teeth and with a single median series extending backward over the basibranchials; nostrils close together, the anterior with a ciliated flap; interorbital space deeply concave; gill openings large, membranes free from isthmus; no gill-rakers, the inner surface of the branchial arches covered with tooth-like asperities; gill filaments short; no pseudobranchiæ; peritoneum silvery.

Scales large, cycloid, 6 rows on cheek; also several on edge of opercle and preopercle; occiput scaly, rest of head bare, with minute rugosities; a broad scaly flap between ventrals; a scaly flap at outer axil of ventral; lateral line slightly decurved at first and then straight to base of caudal.

Origin of dorsal nearer tip of snout than origin of adipose fin by width of interorbital space; origin of anal behind tip of depressed dorsal; anal base long, longer than that of dorsal; caudal deeply forked; pectoral small, not reaching origin of dorsal; ventrals long, reaching beyond base of dorsal, inserted a little before tips of pectorals.

Color in alcohol, pale yellow with irregular longitudinal gray stripes (bluish in life), edged with brownish; silvery yellow below; an oblique black scapular spot; top of head and anterior portion of back mottled with irregular dark streaks and blotches. Fins uniform light yellow, the caudal tipped with blackish.

This fish is not uncommon in the waters of southern Japan. We have examined five specimens from Nagasaki, two from Tokyo, and one from Wakanoura. It is widely distributed through the warmer parts of both oceans.

A comparison of our Japanese specimens, with others from the Hawaiian Islands, Jamaica, and Brazil, reveals no specific differences.

(*μυώψ*, nearsighted).

2. SYNODUS Gronow.

Synodus Gronow, Mus. Ichth., II, 1763, no. 151 (*Synodus*).
Tirus Rafinesque, Caratteri, 1810, p. 56 (*marmoratus*).
Saurus Cuvier, Règne Animal, 1st ed., 1817, p. 169 (*saurus*).
Alpismaris Risso, Eur. Merid., III, 1826, p. 458 (*risso* = young of *saurus*).
Laurida Swainson, Class. Animal., II, 1839, p. 287 (*mediterranea* = *saurus*).

Body elongate, subterete; head depressed; snout triangular, rather pointed; interorbital region transversely concave; mouth very wide; first superior pharyngeal cartilaginous, second toothless, third and fourth separate, with teeth; lower pharyngeals separate; premaxillaries not protractile, very long and strong, more than half length of head; maxillaries closely connected with premaxillaries and very small or obsolete; premaxillaries with one or two series of large, compressed, knife-shaped teeth, the inner and larger depressible; palatine teeth similar, smaller, in a single broad band; lower jaw with a band of rather large teeth, the inner and larger ones depressible; a patch of strong, depressible teeth on tongue in front, a long row along the hyoid bone; jaws subequal; eye rather large, anterior; supraorbital forming a projection above the eye; pseudobranchiæ well developed; gill-rakers very small, spine-like; gill-membranes slightly connected; top of head naked, cheeks and opercles scaled like body; body covered with small, adherent, cycloid scales; no luminous spots; dorsal fin short, rather anterior; pectorals moderate, inserted high; ventrals anterior, not far behind pectorals, large, the inner rays longer than the outer; anal short; caudal narrow, forked; vent posterior, much nearer base of caudal than base of ventrals; branchiostegals 12 to 16; stomach with a long, blind sac and many pyloric cæca; skeleton rather firm.

Species numerous; voracious fishes of moderate size, inhabiting sandy bottoms of most shallow, warm seas.

(*σύν*, together; *ὀδούς*, tooth.)

2. SYNODUS JAPONICUS (Houttuyn).

Cobitis japonica[a] Houttuyn, Verh. Holl. Maat. Harlem, XX, 1782, p. 450 (Nagasaki).

[a] Houttuyn's description of *Cobitis japonica* is very incomplete. It must, however, refer to some species of lizard-fish from Nagasaki. In the number of fin rays the description agrees with the present species, and not with any other. The following is a translation of Houttuyn's account: Head beardless, rather short; mouth with both jaws full of sharp teeth; body terete and fleshy like that of a snake or eel. D. 12; A. 9; P. 12; V. 8. Length, 5 inches. None of the other Japanese species except *Synodus varius* shows such a difference between dorsal and anal.

HIRAKUTSU[a]-ESO (SNAKE-ESO); HIRAKUCHI ESO (WIDE-MOUTH ESO); TORAESO (TIGER ESO); AKAESO (RED ESO); ISE ESO (ESO OF ISE).

Salmo varius LACÉPÈDE, Hist. Nat. Poiss., V, 1803, p. 224, pl. III, fig. 3 (Ile de France).

Saurus varius GÜNTHER, Cat. Fish., V, 1864, p. 395 (in part).—ISHIKAWA, Prel. Cat., 1897, p. 22 (Nagasaki, Riu Kiu Islands).

Synodus varius STEINDACHNER, Denks. Ak. Wiss. Wien, LXX, 1900, p. 513 (Honolulu, Laysan).—JORDAN and SNYDER, Check List, 1901, p. 56.—JORDAN and EVERMANN, Bull. U. S. Fish Comm., XXIII for 1903 (July 29, 1905), Pt. 1, p. 63, pl. II, fig. 14 (Hilo, Honolulu).

Saurus variegatus QUOY and GAIMARD, Voy. Uranie, Poiss., 1824, p. 223, pl. XLVIII, fig. 3 (Maui).

Synodus variegatus SEALE, Occas. Papers Bishop Mus., I, Pt. 4, 1901, p. 63 (Guam).

Synodus synodus BLEEKER, Atlas Syn., p. 154, pl. II, fig. 5 (Java, etc.) (not *Esox synodus* Linnæus).

Saurus lucius TEMMINCK and SCHLEGEL, Fauna Japonica, Poiss., 1847, p. 232, pl. CVI, fig. 1 (Shimabara, near Nagasaki).

Synodus sharpi FOWLER, Proc. Ac. Nat. Sci., Phila., 1900, p. 497, pl. XIX, fig. 2 (Hawaiian Islands).

Habitat.—Western Pacific Ocean and coasts of Asia and India.

Head 3.5 in length; depth 6; width of head 1.67 in its length; depth of head 1.8 in its length; snout 4.75 in head; maxillary 1.6; interorbital space 7; eye 1.5 in snout; pectoral 2.75 in head; ventral about $1\frac{1}{3}$; base of anal 3.5; D. 13; A. 8; P. 13; scales, 5–65–11.

Body elongate, rounded, the back and ventral surface depressed; head large, elongate, depressed, pointed; eye forward, high, the upper margin elevated above profile; mouth very large, oblique; maxillary long, its greatest width anterior to the middle of its length; the mandible very large and powerful; jaws subequal when mouth is closed, the mandible slightly inferior; teeth in jaws in two irregular series, depressible, those in upper jaw more or less visible when mouth is closed; teeth on vomer and palatines depressible, in a narrow band on each side of latter; tongue and basi-branchials with a band of depressible teeth, forming a triangular patch of large ones on the vomer; tongue sharply pointed, free in front; nostrils very close together, the anterior one with a small fleshy flap; interorbital space concave; top of head roughened; gill opening large, the narrow membrane free from isthmus; gill-rakers forming tooth-like asperities on inner surface of branchial arches; gill filaments short, rather coarse, blunt; pseudobranchiæ small, few in number; peritoneum silvery.

Scales large, cycloid; 6 rows on cheek; a series of enlarged scales along margin of preopercle; occiput and sides of head scaly, the rest naked; a broad scaly flap between ventrals and a pointed scale at their outer axil; lateral line nearly straight to base of caudal.

Origin of dorsal midway between tip of snout and origin of adipose dorsal; last dorsal ray a trifle more than half the length of longest

[a] Hirakutsu, "broad-shoe," is the name of a venomous serpent.

ray of fin; origin of adipose dorsal about halfway between tip of last dorsal ray and base of caudal; anal small, its origin before adipose fin; caudal deeply emarginate with pointed lobes; pectoral small, not reaching to dorsal; ventrals large, reaching about to end of base of dorsal.

Color in alcohol, dusky above, sides and belly yellowish, sides of back with about eight or nine dusky cross bars or pairs of bars, these often taking the form of quadrate spots with paler center; an oblique black spot on upper part of opercle; jaws barred; fins, except the pectoral, faintly barred. In life, in Japan as in Honolulu, some specimens have brick-red markings while others from shallower water are olive green. The first are called Akaeso (aka meaning red), the others Ise eso, from the province of Ise. This fish is common throughout the western Pacific from Hawaii to the coasts of Japan. We have 6 specimens from Wakanoura and 3 from Nagasaki. This species is closely allied to the rare Atlantic species, *Synodus synodus* (Linnæus), with which Doctor Bleeker unites it. Specimens of the Atlantic species examined from Bahia have, however, larger scales (58 instead of 65.) If the Pacific Coast species is really distinct, it must apparently stand as *Synodus japonicus*.

3. SAURIDA Cuvier and Valenciennes.

Saurida CUVIER and VALENCIENNES, Hist. Nat. Poiss., XXII, 1849, p. 499 (*tumbil*).

Body elongate, subcylindrical; tail tapering; head oblong, depressed; snout pointed, rather short; eye moderate; mouth cleft oblique, very large; premaxillary very long, styliform, tapering; maxillary thin, long, closely adherent to premaxillary; teeth cardiform, those of inner series longest, slender, depressible both downward and inward, present on jaws, tongue, and palatines, on the latter forming a double band on each side, the inner band shorter than the other; gill-opening very wide, gill membranes not attached to isthmus; branchiostegals numerous; dorsal fin nearly in the middle of length of body, with 13 or fewer rays; adipose fin small; anal short; caudal forked; pectoral short or of moderate length; ventral 9-rayed, the inner rays not much longer than the outer ones, inserted before dorsal, not far from the pectoral.

Fishes of the tropical seas of the western Pacific; species not very numerous.

(σαῦρος, lizard; εἶδος, resemblance.)

KEY TO SPECIES.

a. Adipose eyelid narrow; scales 54; color nearly plain.....*argyrophanes*, 3.
aa. Adipose eyelid broad; scales 63; color nearly plain.....*eso*, 4.

3. SAURIDA ARGYROPHANES (Richardson).

ESO, MAESO (TRUE ESO) NIREDOESO.

Saurus argyrophanes RICHARDSON, Ichth. China, 1846, p. 302 (Canton) (described from a drawing).

Saurida argyrophanes GÜNTHER, Cat. Fish., V, 1864, p. 400 (Chinese and Japanese seas).—NAMIYE, Class. Cat., 1881, p. 106 (Tokyo).—ISHIKAWA, Prel. Cat., 1897, p. 22 (Tokyo).—JORDAN and EVERMANN, Proc. U. S. Nat. Mus., XXV, 1902, p. 329 (Formosa).—JORDAN and SNYDER, Proc. U. S. Nat. Mus., XXIII, 1900, p. 350 (Tokyo); Check List, p. 56, 1901 (Yokohama).

Aulopus elongatus TEMMINCK and SCHLEGEL, Fauna Japonica, Poiss., p. 233, 1847, pl. cv, fig. 2, (Nagasaki).

Habitat.—Coast of Japan and China, southward to the Philippines.

Head $4\frac{1}{3}$ to $4\frac{1}{4}$ in length without caudal; depth varying with age from 7 in very large specimens to 9 in the young; greatest width of head 2 in its length; maxillary $1\frac{1}{2}$ in head; interorbital space equal to snout, 4 in head; D. 11; A. 10; P. 14; V. 9; scales 4–54–6.

Body elongate, subcylindrical, back but little elevated, anteriorly broad and flattened; head long, depressed, broad; snout broad, blunt, with a broad shallow depression on top of snout running back of eyes; a bony protuberance at anterior end of groove, back of tip of snout; eyes well forward, high, 6 in head; adipose eyelid narrow, not extending to pupil; anterior nostril concealed by a thin, fleshy flap.

Mouth large, oblique, the jaws equal; lips narrow, so that teeth are visible; teeth in several rows, those of inner row much the largest; palatines armed with rows or bands of small or fine teeth, those of inner rows much larger than the rest; tongue small, free anteriorly, covered with bands of fine teeth; branchial arches with bands of fine teeth, those in throat largest; all teeth depressible inward. Gill openings very large, the gill membranes free from isthmus; gill filaments moderately long, rather coarse and blunt; pseudobranchiæ numerous, well developed. Lateral line straight, keeled, strongly so posteriorly.

Scales large, cycloid, rather deciduous, three rows on cheeks; opercles and occiput scaled, rest of head naked; caudal scaled nearly its whole length; a very long, narrow, pointed scale at upper axil of pectoral; a similar one at ventral is more than twice as long as the broad pointed scale at inner angle of ventral and eventually reaches more than half the length of the ventral fin. Dorsal and anal each with a basal sheath of long, narrow, pointed scales.

Dorsal short, high, its longest spine $1\frac{1}{3}$ in head, decreasing in height very rapidly, the last spine less than $\frac{1}{4}$ as long as second (in one large specimen the second spine is $1\frac{1}{5}$ times longer than head); the distance from tip of snout to origin of dorsal equals distance from origin of dorsal to posterior margin of depressed adipose dorsal;

the latter fin very small; pectoral comparatively long, reaching to a point above origin of ventral, or beyond; ventral reaching less than halfway to vent; anal fin small, the distance from its origin to base of caudal about equal to length of head; caudal deeply forked.

Color in alcohol, dull brown above lateral line, becoming silvery yellow below. Pectorals, dorsals, and caudal tipped with blackish; ventrals and anal uniform yellowish.

Of this species we have examined 7 specimens from Wakanoura, 6 from Nagasaki, 3 from Kobe, 2 from Tokyo, and 1 from Kawatana. It was seen also at Hakata and at Hiroshima. It is generally common in southern Japan, and is a common food fish in the markets. *Aulopus elongatus* Schlegel seems to be this species, the figure showing no adipose eyelid, but the number of scales is too large. *Saurus argyrophanes* we place here, as Günther counts 54 scales and Richardson does not speak of the adipose eyelid.

(*ἀργύροες*, silvery; *φαίνω*, to show.)

4. SAURIDA ESO Jordan and Herre, new species.

ESO, OESO (LARGE ESO).

Saurus badi Cantor, Catalogue of Malayan Fishes. 1850, p. 270 (Sea of Pinang, Malayan Peninsula, Singapore); (not *Saurus badi* Cuvier, an Indian species, with the ventrals blackish, the scales 55, and the adipose eyelid large.)

Saurida japonica Jordan and Evermann, Proc. U. S. Nat. Mus., XXV, 1902, p. 329 (*comparison with S. argyrophanes*) (not *Cobitis japonicus* of Houttuyn).

Habitat.—South coasts of Japan, south to Malaysia.

Head $4\frac{5}{8}$ in length without caudal; depth $7\frac{3}{8}$; greatest width of head $1\frac{5}{7}$ in its length; maxillary $1\frac{1}{2}$ in head; interorbital space equals

Fig. 1.—Saurida eso.

distance from tip of snout to middle of pupil, a trifle more than 3 in head; snout $3\frac{1}{2}$ in head; D. 11; A. 10; P. 14; V. 9; scales 5–63–7.

Body elongate, subcylindrical, becoming somewhat compressed and laterally keeled on posterior portion; head depressed, broad; snout broad, flat, rather blunt; eye placed well forward, $5\frac{1}{2}$ in head; adipose eyelid well developed, broad, extending to or partly covering pupil; much larger than in *Saurida argyrophanes*. Anterior nostril with a well-developed fleshy flap or tube. Top of head with numerous dendritic muciferous tubules.

Mouth large, slightly oblique, the mandible slightly inferior; teeth in several rows, those of inner row largest, exposed by the narrow, thin lip; pterygoids, palatines, tongue, and gill arches with bands of fine teeth, those of inner row usually largest; all teeth depressible inward; no teeth on vomer. Gill openings very large, membranes free from isthmus; gill filaments moderately coarse, blunt; pseudobranchiæ numerous, large. Lateral line straight, prominent, and strongly keeled posteriorly.

Scales of medium size, cycloid; four rows on cheeks, opercles scaled; one or two scales at center of posterior margin of occiput; remainder of head naked. Caudal fin scaled; a long, pointed and very thin scale at axil of pectoral; a long, broad, rounded scale at outer angle of ventral, less than half the length of fin; at inner angle of fin a large pointed scale, nearly as long as the outer one; dorsal and anal fins each with a basal sheath of elongated, pointed scales.

Dorsal fin short, high, the second spine about $1\frac{1}{4}$ in head, the last spine about $\frac{1}{5}$ as long as second; distance from tip of snout to origin of first dorsal equals distance from the latter to posterior margin of base of adipose dorsal; pectoral medium, falling considerably short of a point above origin of ventral, $1\frac{5}{7}$ in head; adipose dorsal very small, inserted above middle of anal; ventrals inserted forward of first dorsal and extending a trifle beyond its posterior margin; anal short, its length little more than $\frac{1}{3}$ of head; distance from its origin to base of caudal approximately equals length of head; caudal medium, deeply forked.

Color in alcohol, dusky brown above lateral line, some scales with paler centers; below, more or less abruptly, silvery yellow; pectorals dorsals, and caudal tipped with blackish; ventrals and anal uniform yellowish.

Here described from the type, Cat. No. 57847, U. S. Nat. Mus., $13\frac{1}{4}$ inches long, from Wakanoura. We have also examined two cotypes from Kobe and one from Tsuruga, Nos. 20161 and 20162, Stanford University.

This is the largest species in the group. It differs from *Saurida argyrophanes* in the comparative proportions of the pectoral fin, and of the outer axillary ventral scale, in the greater breath of the head, and especially in the greater number of scales in the lateral line, the larger adipose eyelid, and in the absence of the marked occipital depression.

Saurida tumbil Cuvier has been recorded from Japan by Bleeker, but doubtless *S. eso* has been mistaken for it. *Saurida tumbil* of the East Indies has the adipose eyelid small, the scales 60, and the back barred with blackish.

(*Eso*, Japanese name of the species of *Synodus* and *Saurida*.)

4. HARPODON Le Sueur.

Harpodon LE SUEUR, Journ. Ac. Nat. Sci. Phila., V, 1825, p. 50 (*microps*=*nehereus*) (misprinted *Harpadon*).

Triurus SWAINSON, Class. Anim., 1839, II, p. 288 (*microcephalus*=*nehereus*).

Saurida chthys BLEEKER, Pisces Java, Nat. Tyd. Ind., XV, 1856, p. 163 (*ophiodon*=*nehereus*).

Body elongate, compressed; snout short; bones of head soft and partly modified into wide muciferous channels; eyes small. Cleft of mouth deep; margin of upper jaw formed by the premaxillaries, which are thin and tapering; no maxillaries. Teeth cardiform, recurved, unequal in size, depressible, the largest on the jaws and more or less barbed. Teeth on premaxillaries, mandible, palatines, tongue, and hyoid. Branchiostegals from 23 to 25; gill openings wide; gill membranes free from isthmus.

Dorsal short, near middle of body length; adipose fin small; pectorals and ventrals long; caudal three lobed.

Scales thin, deciduous, none on the anterior portion of the body, no luminous spots. No air bladder; pyloric appendages 16.

Dorsal fin short, of soft rays only; pectorals and ventrals present; anal moderate or long; caudal forked.

Skeleton rather well ossified; air bladder small or wanting; intestinal canal short; no eggs inclosed in the sacs of the ovary and extended through an oviduct.

Species few, Asiatic, one of them being the well-known "Bombay Duck," or Bummaloh, *Harpodon nehereus*, used when dried as a condiment. A shore fish of wide distribution, the Japanese species in deep water.

(ἅρπη, scythe; ὀδούς, tooth.)

5. HARPODON MICROCHIR Günther.

MIZUTENGU (WATER GOBLIN.)

Harpodon microchir GÜNTHER, Ann. and Mag. Nat. Hist., 1878, p. 487 (off Tokyo); Report on the Shore Fishes of the Challenger, 1880, p. 71 (Tokyo) (same specimens).

Habitat.—Open sea off Japan.

Head $5\frac{1}{6}$ to $5\frac{9}{11}$ in total length without caudal; depth from $7\frac{1}{2}$ to $8\frac{1}{2}$; interorbital space 4 in head; intermaxillary $1\frac{1}{4}$; eye small, about 9 in head. D. 14; A. 14; P. 11; V. 9.

Lateral line 58 to 60, extending to extremity of central caudal lobe. Body slender, elongate, subcylindrical, the posterior portion somewhat laterally compressed; head broad above, with prominent bony ridges; a bony tubercle just behind the very short broad snout; opercular flap prolonged, large, thin, membranaceous; eye well forward, high, with a narrow adipose lid encircling the orbital space;

nostrils close together, the anterior one small, covered by a fleshy flap; posterior nostril large, open; 2 or 3 minute pores between anterior nostril and tip of snout; top of head with 2 lateral and 1 median broad muciferous channel; mouth very large; the lower jaw strongly projecting; lips narrow, exposing the teeth; these arranged in two or three rows, recurved, depressible inward, straight, arrow-shaped or with a single barb at posterior margin of the point; teeth of inner row largest. Bands of unequal, recurved, inwardly depressible teeth also on tongue, inner side of gill arches, and palatines, the last having two bands. Gill openings very large, membranes free from isthmus; gill filaments rather short, moderately coarse; pseudobranchiæ small, few in number. Lateral line straight, formed of elongate, thin, pointed scales; a pore above and below each scale.

Scales small, cycloid, on posterior portion of body, extending forward to ventrals on belly, but above the lateral line ceasing at posterior end of depressed dorsal. Basal portion of adipose dorsal

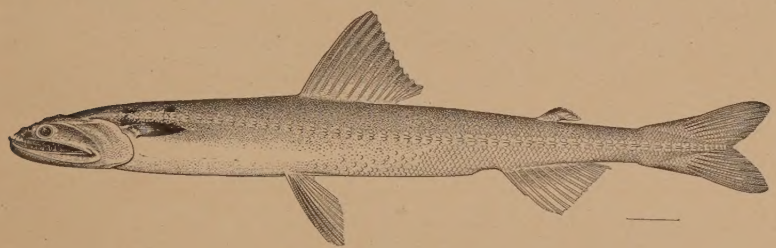

FIG. 2.—HARPODON MICROCHIR.

scaled. Remainder of body naked except for a row of minute scales on either side of lateral line.

Dorsal fin short, moderately high; the third spine highest, from 6½ to 7 in total length; distance from tip of snout to origin of first dorsal equal to, or slightly greater than, distance from the latter point to posterior margin of depressed adipose dorsal; pectoral small, its length about 2½ in head; adipose dorsal small, inserted over middle of anal; ventrals inserted just forward of first dorsal and extending posteriorly beyond insertion of dorsal; anal moderate, its length variable, in some specimens longer and in others shorter than dorsal; caudal medium, of three pointed lobes, the central one much the smallest.

Color, translucent brownish, in spirits, dusky above, becoming brownish or yellowish laterally; throat, belly, and lower part of head silvery gray with a pinkish suffusion. Pectorals black; ventrals and anal whitish or yellow; dorsal and caudal dusky or blackish.

We have examined twelve specimens of this singular and rare fish, ranging in length from 11½ inches to 16 inches. They were taken in

deep water off the headland of Awa at the entrance to the Bay of Tokyo.

The species was previously known from a single specimen 27 inches long obtained by the *Challenger* expedition at Tokyo. The species is regarded as a food fish, although very rare. It differs from *Harpodon nehereus* in the small pectorals.

(μικρός, small; χείρ hand.)

SUMMARY.

Family SYNODONTIDÆ.

1. *Trachinocephalus* Gill, 1861.

1. *myops* Forster, 1801; Tokyo, Wakanoura, Nagasaki.

2. *Synodus* Gronow, 1763.

2. *japonicus* (Houttuyn), 1782; Wakanoura, Nagasaki.

3. *Saurida* Cuvier and Valenciennes, 1849.

3. *argyrophanes* (Richardson) 1846; Tokyo, Kobe, Hiroshima, Wakanoura, Kawatana, Hakata, Nagasaki.

4. *eso* Jordan and Herre, 1907; Wakanoura, Kobe, Tsuruga.

4. *Harpodon* Le Sueur, 1825

5. *microchir* Günther, 1878, Tokyo.